

The combined teachings of the applied references fail to suggest the feature recited in claim 1 of selectively and epitaxially growing a single crystalline film on an exposed surface of a single crystalline substrate, via an opening in an amorphous film formed on the substrate.

The Office Action proposes that Tokunaga discloses in column 2, lines 14-29, prior art in which GaAs is laterally overgrown on an amorphous  $\text{SiO}_2$  or  $\text{Si}_3\text{N}_4$  film (Office Action page 3, lines 5-7). However, Tokunaga does not disclose epitaxial lateral overgrowth anywhere within the specification. Instead, Tokunaga discloses in the cited portion that selective deposition methods are known in which a monocrystal substrate is covered partially with an amorphous thin film and the same material as the substrate material is epitaxially grown selectively only at the exposed portion of the monocrystal substrate (Tokunaga col. 2, lines 13-17). Since the epitaxial growth occurs only at the exposed portion of the monocrystal substrate, and not anywhere on the amorphous thin film, it necessarily follows that this epitaxial growth is not providing lateral overgrowth.

The Office Action further proposes that Tokunaga suggests the equivalence of MBE and CVD for the growth of epitaxial films (Office Action page 3, 2<sup>nd</sup> sentence of 3<sup>rd</sup> paragraph). This

suggestion is proposed to be provided by Tokunaga in column 1, lines 14-29, and column 7, lines 15-24.

However, Tokunaga discloses in column 1, lines 24-37, that a substrate 1 comprising a material species with uniform composition, as shown in Fig. 1A, is washed and then a thin film 2 is deposited on the whole surface of substrate 1 according to various thin film depositing methods (vacuum vapor deposition method, sputtering method, plasma discharging method, MBE method, CVD method, etc.) (Fig. 1B) (Tokunaga col. 1, lines 24-32). Subsequently, onto thin film 2 there is applied a photoresist 3 (Fig. 1C) and photoresist 3 is exposed to light by use of a photomask of a desired pattern and photoresist 3 is removed partially by development (Fig. 1D) (col. 1, lines 33-37).

Nothing in the above passage from Tokunaga's disclosure suggests an equivalence of MBE and CVD. Instead, this passage merely states that various methods of film deposition may be applied to grow a film on a substrate. The mere existence of various epitaxial growing methods, alone, provides no evidence of their equivalence, much less so of their equivalence for a specific application. As a result, Tokunaga does not suggest the equivalence of CVD and MBE for the specific application of selectively growing epitaxial nitride films upon an amorphous masking layer, as concluded in the Office Action (see Office

Action page 3, fourth paragraph). Moreover, Tokunaga does not suggest the equivalence of CVD and molecular, atomic, or chemical beams for the specific application of selectively and epitaxially growing a single crystalline film on an exposed surface of a single crystalline substrate via an opening in an amorphous film formed on the substrate, as recited in claim 1.

With regard to column 7, Tokunaga discloses that in the respective Examples 1-3, described in columns 4-7, the MOCVD method is used in the step of selective growth of GaAs and GaAlAs films, but selective growth of the III-V group compound film can be performed also according to the same principle by use of the MBE method (Tokunaga col. 7, lines 17-23). Simply put, Tokunaga discloses that MBE may be used for the selective growth of a III-V group compound film in three specific examples, Examples 1-3. Tokunaga does not suggest that MBE may be used instead of CVD for any other specific applications, such as the claimed application or that described in column 2, lines 13-34, of the reference. Moreover, for the reasons provided below, the use of MBE in Tokunaga's Examples 1-3 does not suggest an equivalence of MBE and CVD for the specific application of selectively and epitaxially growing a single crystalline film on an exposed surface of a single crystalline substrate via an opening in an amorphous film formed on the substrate, as recited in claim 1.

In Example 1, illustrated by Figs. 5A-5E, Tokunaga discloses implanting As ions 14 in wells formed in an SiO<sub>2</sub> film 10. Thereafter, a GaAs film 15 is grown on the As implanted regions within the wells of SiO<sub>2</sub> film 10 (see Tokunaga Figs. 5C-5E and col. 5, lines 20-25). In Example 2, illustrated by Figs. 6A-6E, a patterned Al<sub>2</sub>O<sub>3</sub> film 16 is formed on an SiO<sub>2</sub> film 10 overlying a substrate and a GaAs film 15 is selectively grown on Al<sub>2</sub>O<sub>3</sub> film 16, but not on SiO<sub>2</sub> film 10 (see col. 6, lines 2-6). Tokunaga's Example 3 differs from Example 1 in that a GaAlAs film, rather than a GaAs film, is grown on the As implanted regions within the wells of SiO<sub>2</sub> film 10 (see col. 6, lines 40-43). Tokunaga does not suggest lateral overgrowth and does not suggest lateral overgrowth of an amorphous film by epitaxially growing a single crystalline film on a single crystalline substrate through an opening in the amorphous layer formed on the substrate.

Accordingly, Applicant submits that Tokunaga does not suggest the feature recited in claim 1 of using molecular, atomic, or chemical beams for selectively and epitaxially growing a single crystalline film on an exposed surface of a single crystalline substrate via an opening in an amorphous film formed on the substrate. Therefore, allowance of claim 1 and all claims dependent therefrom is warranted.

Moreover, Applicant submits that the operating condition and apparatus of the CVD film forming technique are also quite different from those of the MBE film forming technique. For example, with the CVD technique, only gas sources are required. With the MBE technique, a beam source is required in addition to gas sources, so that the MBE apparatus structure becomes more complicated than the CVD apparatus structure. With the CVD technique, the raw material gases are non-directionally supplied onto a substrate and the incident angle of the raw material gases cannot be controlled. With the MBE technique, the molecular or atomic beam is directionally supplied onto a substrate, which makes the MBE technique more complicated than the CVD technique.

Additionally, for conventional epitaxial growth, the molecular or atomic beam is supplied substantially perpendicular to the substrate. If the beam is supplied at a slant, such as an angle of not more than 40 degrees, the epitaxial growth may not be realized and some voids are created in the resultant film.

Furthermore, Nakamura suggests an incident angle of 90 degrees, since the growth rate continuously decreases as the incident angle increasingly approaches zero.

Also, the applied references do not teach the reduction of dislocation density in the combination of the MBE technique and

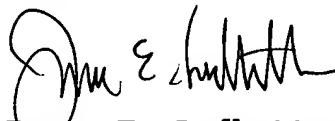
the slanted angle of beam incidence, of 40 degrees or below,  
using lateral growth.

Accordingly, Applicant submits that the applied references  
do not suggest the subject matter defined by claim 1. Therefore,  
allowance of claim 1 and all claims dependent therefrom is  
warranted for these independent reasons.

In view of the above, it is submitted that this application  
is in condition for allowance, and a notice to that effect is  
respectfully solicited.

If any issues remain which may best be resolved through a  
telephone communication, the Examiner is requested to telephone  
the undersigned at the local Washington, D.C. telephone number  
listed below.

Respectfully submitted,



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JEL/DWW/att

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